Public Release Report for Alsip Paper Condominium Association ESA-040

1. Introduction:

   This powerhouse facility generates high-pressure superheated steam for distribution to two paper industry plants located nearby. The consortium “member” companies reimburse the powerhouse business entity for their respective share of the operating cost (natural gas and electricity) of the steam-generating facility. The powerhouse contains two identical 110,000 lb/hr. boilers producing 400 psig. steam at 520 ^{o}F. Installed equipment also includes a 12,000 HP gas-fired turbine-generator set but this system has not been operated since 2004 due to unfavorable energy market costs. Gas burners installed in the gas turbine exhaust ductwork are utilized on an occasional basis to generate steam when one of the primary boilers is not operated due to the performance of maintenance activities. For this use, the gas turbine is operated but the electrical breaker is left open (no electricity production).

2. Objective of ESA:

   The objective of this ESA was twofold:
   a) To train company/plant personnel in the use of the DOE Steam Tool software.
   b) To perform a "training assessment" of plant equipment and processes leading to the recommendation of measures for achieving substantial plant energy savings.

3. Focus for Assessment:

   The ESA focused on facility steam production and use with an emphasis on natural gas as boiler fuel.

4. Approach for ESA:

   The ESA Expert worked directly and continuously on-site with a single key company representative (Flowers) on DOE steam software training and on the identification and simulation of energy conservation projects. A plant inspection provided the opportunity to document current practices and to acquire plant-measured data needed for SSAT simulations.

5. General Observations of Potential Opportunities:

   a) Purchased energy annual consumption:

      <u>Natural gas</u>
      Consumption (2005): 1,283,401 x 10^6 BTU/yr.

      <u>Electricity</u>
      Consumption (2005): 6,155,168 kWh/yr.

b) SSST Results:

Steam system profiling: 89/90 pts. = 99% (DOE database plants: 59%)
Steam system operating practices: 140/140 pts. = 100% (DOE database plants: 74%)
Boiler plant operating practices: 75/80 pts. = 94% (DOE database plants: 62%)
Distribution, end use, recovery, operating practices: 30/30 pts. = 100% (DOE database plants: 54%)
Overall score: 334/340 pts. = 98% (DOE database plants: 66%)

These SSST results are quite exceptional and give evidence of a highly-efficient, well-managed facility leaving limited opportunity for additional improvement.

6. Energy Saving Opportunities:

1. Install blowdown post-flash liquid heat exchanger (SSAT #12)

   Boiler blowdown currently enters a flash vessel from which low-pressure flash steam is directed to the dearator. Heat recovery is not achieved for the residual hot liquid exiting the flash vessel. A substantial fraction of this heat can be recovered for feedwater pre-heating with the installation of a properly-sized heat exchanger. Since blowdown water contains contaminants at substantial concentration levels, fouling of the heat exchanger surfaces may occur. For this reason, the exchanger should be specified to be constructed of quality materials and should be easy to disassemble for periodic cleaning and maintenance. (**Medium-term opportunity;** potential gas saving: 1 %)

2. Install reverse osmosis system and reduce blowdown (SSAT #4)

   The plant has installed and currently utilizes a high-quality boiler feedwater demineralization system. While current treatment prevents significant water-side fouling in the boilers, a significant blowdown flowrate (7% of feedwater flow) is needed for this purpose. If the feedwater is further purified with use of a reverse osmosis system, a significant reduction in blowdown can be achieved. (**Medium-term opportunity**; potential gas savings: 0.7 %)

3. Insulate boiler mud drums (SSAT #3)

   The boilers and entire steam system in the boilerhouse are very well-insulated including all significantly-sized valve bodies. However, the original design of the boilers did not include an insulating layer on the lower-most cylindrical mud drums. These surfaces are at high temperature during continuous operation of both boilers. The addition of a modest layer of insulation to the mud drum surfaces will result in a significant energy saving. Since the mud drums are located at boilerhouse floor level, installation will be straightforward. (**Near-term opportunity**; potential gas savings: 0.5%)

4. Valve-off Boiler #3 header (SSAT #1)

   The unit referred to as "Boiler #3" is actually a heat recovery unit in the exhaust system of the installed gas turbine-generator. As indicated above, the gas turbine has not been operated since 2004 due to an unfavorable ratio of gas to electricity cost. However, there are supplemental gas burners installed in the exhaust ductwork and these are used occassionally to produce some steam when one of the two primary boilers is shut down for maintenance. Currently, steam is allowed to back-up into the waste-heat boiler which is maintained on a hot-standby condition. Substantial energy can be saved if the steam line serving Boiler #3 is valved off during periods of non-use. (**Medium-term opportunity**; potential gas savings: 0.3%)

5. Improve Boiler #1 O2 trim

   While overall boiler operation is near ideal conditions, it was noted that there is a slightly different stack O2 value resulting from combustion air sufficient to avoid the production of combustibles in the stack gas of the two boilers. Boiler #2 stack O2 = 2.6%, Boiler #1 stack O2 = 3.8%. If combustion air in Boiler #1 could be reduced to achieve a level matching that of Boiler #2, a modest amount of energy could be saved. A boiler consultant should be employed to investigate the cause of the higher O2 value in Boiler #1. Possibilities include degraded burner function, need for sensor recalibration, boiler casing air infiltration among others. (**Near-term opportunity**; potential gas savings: 0.1%)

   Summary of potential gas savings:

   Near-term measures: 6,132 x 10^6 Btu/yr.
   Medium-term measures: 29,784 x 10^6 Btu/yr.
   Long-term measures: 0%

7. Management Support and Comments:

   Mr. Rick Flowers, the facility Manager of Utility Services is the top management person overseeing the operation of the assessed steam production facility. Mr. Flowers was highly enthusiastic throughout the process of preparing for the plant visit and the conducting of the on-site assessment. (A large volume of material and data was provided in advance of the plant visit). Mr. Flowers had detailed knowledge of the facility characteristics and operating procedures. All questions posed by the ESA Expert were thoroughly answered. In sum, the support for the ESA was exceptionally high. Mr. Flowers desires to maintain steam production energy costs as low as possible for his facility, and he is eager to consider further the energy saving opportunities specified in this report.

8. DOE Contact at plant/company

   Plant: Rick Flowers, Manager of Utilities Services (points of contact above)

   Company: Same (Rick Flowers)